



Fig. 2. The Client-Server architecture of Distributed Collaborative Virtual Wind Tunnel. Simulation data reside on the server (top), where visualization geometry is computed and sent to multiple-user clients (bottom). User commands are sent from each client, causing new visualization geometry to be computed by the server, which is then sent to all clients. Note that the clients can have different types of display and each sees the data from his own point of view.

**Point of Contact: S. Bryson**  
 (650) 604-4524  
 bryson@nas.nasa.gov

The main objective was to devise an experiment to study wake flow under conditions of adverse pressure gradient for the purpose of obtaining data useful in assessing and improving turbulence models for high-lift systems. Other objectives included obtaining laser Doppler velocimeter (LDV) measurements of velocity and turbulent Reynolds stress in a wake with reversed flow and studying the sensitivity of the wake to pressure gradient (flow divergence), asymmetry, and Reynolds number.

Experiments were performed in the High Reynolds Channel 1 wind tunnel at Ames. Wake flow behind a splitter plate was subjected to an adverse pressure gradient by passing the flow through a divergent wall test section. Boundary layers on the wind tunnel walls were prevented from separating with tangential blowing. High Reynolds number flows ( $Re_c = 10$  million) were achieved by pressurizing the wind tunnel to 6 atmospheres. Two component LDV measurements of velocity and Reynolds stress were obtained for several test cases including separation. The figure shows the tunnel geometry with streamlines (derived from the velocity measurements) superimposed for a case with reversed flow along the centerline of the wake. Also shown are the measurements of the  $-uv$  turbulent Reynolds stress for the upper half of the channel. The flow was remarkably stable and repeatable with good spanwise uniformity.

**Point of Contact: D. Driver**  
 (650) 604-5396  
 ddriver@mail.arc.nasa.gov

## Wake Flow in Adverse Pressure Gradient

Dave Driver

High lift developed by multi-element airfoils can be limited by flow reversals in the wake of the main element. Turbulent mixing in the wake controls the growth of the wake and dictates the extent to which the wake experiences flow reversal. Consequently, subtle differences in turbulence models make a significant difference in the prediction of wake growth. The AST program, in an effort to improve predictions of high-lift systems, provided funding for basic experiments that would provide data for guiding turbulence model development.